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IMAGE DISPLAY APPARATUS

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1 BACKGROUND OF THE INVENTION

The present invention relates to an image display apparatus including an input unit such as a keyboard, a computer body and a display unit, and more particularly to an image display apparatus in which a display size, a display position and brightness of a picture in the display unit can be adjusted by the input unit such as the keyboard through the computer body to improve the handling capability. The image display apparatus of the present invention can be used in a work station and an advanced personal computer using a display unit.

At present, in the display units for a computer terminal, the display position and size of the picture and a deflection frequency of a video signal to be displayed are variously different. Accordingly, one display unit for the computer terminal is designed to be able to treat various video signals.

The display unit of this type employs a microcomputer and an LSI memory to provide an optimum picture display for each kind of video signals. Such a display unit in a prior art is disclosed in Japanese Patent Unexamined Publication No. 1-321475, for example.

This conventional display unit is directed to a multi-scan type CRT display unit, which includes a

1 memory in which information relative to display  
positions and sizes of the picture is stored for each  
kind of video signals and which is controlled by a  
microcomputer in that display unit. The information  
5 relative to the optimum display position and size of the  
picture in accordance with an input video signal is read  
out from the memory and a deflection circuit of the  
display unit is controlled by the read-out information.  
Further, when a video signal inputted in the display  
10 unit is not known, the memory stores no information  
relative to the inputted video signal and accordingly  
adjustment switches disposed on a front panel of the  
display unit are operated without the intervention of  
the computer so that information for adjusting the  
15 display position and the display size of the picture is  
inputted. A control circuit such as the microcomputer  
prepares information for control including deflection  
and makes adjustment.

In the prior art described above, the display  
20 unit is designed to obtain the optimum picture display  
in accordance with the input video signal, while, in  
another prior art, a display state is controlled to be  
switched from the computer body in accordance with the  
variety of the multi-media. Such a display unit in the  
25 prior art is disclosed in Japanese Patent Unexamined  
Publication No. 2-60193.

This conventional display unit is directed to  
a CRT display apparatus used in display of an electronic

1 apparatus such as a personal computer and which can  
switch the number of scanning lines between 200 lines  
and 400 lines freely and be shared by a television  
receiver.

5 More particularly, in the above prior art, the  
computer body produces a discrimination signal super-  
posed on an video signal during a blanking period and  
the display unit switches the deflection frequency on  
the basis of the discrimination signal.

10 In the former prior art (Publication No. 1-  
321475) of the above two prior arts, since the display  
position and size of the picture are all controlled by  
the display unit, it is necessary for the operator to  
separate his fingers from the input unit such as the  
15 keyboard connected to the computer body and extend his  
hands to the adjustment switches of the display unit  
disposed at a separate location to operate the switches  
when the adjustment of the display position and size of  
the picture are required. Accordingly, it is trouble-  
20 some in the handling capability.

Further, in the latter prior art (Publication  
No. 2-60193), the display state is controlled by the  
input unit such as the keyboard connected to the  
computer body, while since only the deflection frequency  
25 can be switched only by a binary value, there is a  
problem that only two specific signals can be treated  
and a sufficient display state required by the user of  
the computer can not be obtained.

1 SUMMARY OF THE INVENTION

It is a primary object of the present invention to solve the problems in the prior arts by providing an image display apparatus capable of adjusting a display picture by an input unit such as a keyboard near at hand through a computer body without extending the hands to adjustment switches of a display unit and obtaining a display state required by the user exactly.

10 It is another object of the present invention to improve the operability in a computer system and the handling capability of the image display apparatus.

It is still another object of the present invention to provide an image display apparatus capable of adjusting a display picture from a computer body by using a conventional circuit without the provision of a new circuit.

In order to solve the above problems, according to the present invention, in a general computer system, a computer body comprises addition means for adding a control signal for a display picture to a video signal or a synchronizing signal and a display unit comprises separation means for separating the added control signal and control means for adjusting the display state on the basis of the separated control signal.

Alternatively, the computer body comprises preparation means for preparing the control signal to produce it with a predetermined system and the display

1 unit comprises control means for receiving the control  
signal to adjust the display state on the basis of the  
control signal.

Alternatively, the computer body comprises  
5 display processing means for producing the prepared  
image data and the control signal for the display  
picture in the form of a digital signal to the display  
unit and the display unit comprises control means for  
preparing an analog video signal and synchronizing  
10 signal from the image data and producing an adjustment  
signal for adjusting a predetermined location of the  
display unit on the basis of the control signal.

Alternatively, the computer body comprises  
modulation means for adding the control signal for the  
15 display picture to an AC power supply for operating the  
computer body and the display unit comprises demodu-  
lation means for separating the modulated control signal  
and control means for adjusting an internal circuit of  
the display unit by the control signal from the demodu-  
20 lation means to obtain a predetermined display picture.

Further alternatively, the control signal from  
the input unit such as the keyboard is received by the  
display unit as it is and the display unit comprises  
instruction identification means for identifying the  
25 control signal relative to the adjustment of the display  
picture and control means for adjusting the display  
picture on the basis of a signal from the instruction  
identification means.

1           The addition means of the computer body adds  
the control signal for the display unit to the video  
signal or the synchronizing signal produced by the  
computer body when the instruction inputted by the input  
5   unit such as the keyboard relates to the adjustment of  
the display picture of the display unit. In the display  
unit, the separation means takes out the added control  
signal and the control means adjusts the internal cir-  
cuit of the display unit in accordance with the control  
10   signal to thereby display a predetermined picture.

          Alternatively, the preparation means prepares  
a control signal in accordance with the control signal  
for the display picture from the input unit such as the  
keyboard and produces it through an exclusive connection  
15   line, and when the control means of the display unit  
receives the control signal, the control means adjusts a  
predetermined portion of the internal circuit of the  
display unit in accordance with the control signal and  
adjusts the display picture.

20           Alternatively, the display processing means  
processes a drawing instruction prepared by a CPU in the  
computer body to prepare image data for displaying a  
video signal and prepare a control signal for the  
display picture, so that the image data and the control  
25   signal are produced to the display unit with a predeter-  
mined system for transmission and reception of a digital  
signal. Further, the control means receives the image  
data and the control signal from the display processing

1 means and prepares the video signal, the synchronizing  
signal and the adjustment signal for the internal  
circuit of the display unit.

5 Alternatively, the modulation means prepares  
the control signal for the display picture from the  
information or instruction relative to the adjustment of  
the display picture and adds the control signal to the  
AC power supply for the computer body to transmit the  
control signal. The demodulation means extracts the  
10 control signal added by the modulation means. The  
control means adjusts a predetermined portion of the  
internal circuit of the display unit on the basis of the  
control signal from the demodulation means to adjust the  
display picture.

15 Further alternatively, the instruction  
identification means identifies a signal relative to the  
adjustment of the display picture from signals directly  
inputted by the input unit such as the keyboard to  
prepares the control signal for adjustment. The control  
20 means adjusts the predetermined portion of the internal  
circuit of the display unit in accordance with the con-  
trol signal from the instruction identification means to  
adjust the display picture.

#### BRIEF DESCRIPTION OF THE DRAWINGS

25 Preferred embodiments of the present invention  
will now be described in conjunction with the accompany-  
ing drawings, in which:



1            Fig. 1 is a block diagram schematically illustrating a first embodiment of an image display apparatus according to the present invention;

            Fig. 2 is a block diagram schematically illustrating an actual example of a control signal addition  
5            circuit and a display control circuit shown in Fig. 1;

            Fig. 3 is a waveform diagram of signals of Fig. 2;

            Fig. 4 is a block diagram schematically illustrating an actual example of a control signal separation  
10           circuit and the display control circuit shown in Fig. 1;

            Fig. 5 is a waveform diagram of signals of Fig. 4;

            Fig. 6 is a block diagram schematically illustrating another actual example of the control signal  
15           addition circuit and the display control circuit shown in Fig. 1;

            Fig. 7 is a block diagram schematically illustrating a second embodiment of an image display  
20           apparatus according to the present invention;

            Fig. 8 is a block diagram schematically illustrating a third embodiment of an image display apparatus according to the present invention;

            Fig. 9 is a block diagram schematically illustrating a fourth embodiment of an image display  
25           apparatus according to the present invention; and

            Fig. 10 is a block diagram schematically illustrating a fifth embodiment of an image display

1 apparatus according to the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a block diagram schematically illustrating a first embodiment of an image display apparatus according to the present invention. In Fig. 1, numeral 5 1a denotes a computer body, in which numeral 11 a CPU, 12 an input unit interface connected to the computer body 1a for processing various instruction signals inputted from a first input unit 10 (which transmits a 10 user's intention to the computer) such as a keyboard, a mouse, a pen for input, 13 a memory circuit constituting a main memory, 14 an input/output port for connection with a peripheral device not shown, 15 a display control circuit for producing a video signal and a synchronizing 15 signal for driving a display unit, 16 a control signal addition circuit for superposing or adding a control signal to the video signal or the synchronizing signal produced by the display control circuit 15, and 17 an external memory constituted by a floppy disk, a hard 20 disk or a memory card which is disposed separately from the memory circuit 13. Further, numeral 1b denotes a display unit, in which numeral 18 denotes a control signal separation circuit for extracting the control signal from the video signal or the synchronizing signal 25 on which the control signal produced by the control signal addition circuit 16 is superposed, 19 a first display control circuit for producing an adjustment

1 signal for a predetermined circuit on the basis of the  
control signal extracted by the control signal separa-  
tion circuit 18, 20 a video circuit, 21 a deflection  
circuit constituting display drive means, and 22 a  
5 cathode ray tube for displaying a video signal.

Operation of Fig. 1 is now described. In the  
computer body 1a, other portions except the control  
signal addition circuit 16 are the same as the general  
configuration of a conventional personal computer or  
10 work station.

When the user of the computer inputs a control  
instruction for adjustment of the display picture in the  
display unit 1b by means of a first input unit 10 such  
as a keyboard, a mouse, a pen for input connected to the  
15 computer body 1a, the input unit interface 12 converts  
the control instruction into a digital signal, which is  
recognized by the CPU 11 which controls the control  
signal addition circuit 16.

The control signal addition circuit 16 pre-  
20 pares a control signal  $S_c$  in accordance with the control  
instruction. The control signal  $S_c$  for the display unit  
1b is superposed during the vertical retrace period on  
the video signal R, G or B or the synchronizing signal  
for display produced by the display control circuit 15.  
25 The signal on which the control signal  $S_c$  is superposed  
is represented with the prime ( $'$ ). The control signal  
 $S_c$  is prepared in accordance with the control instruc-  
tion inputted in the input unit 10.

1           The control signal separation circuit 18 of  
the display unit 1b separates the added control signal  
Sc from the video signal R, G or B or the synchronizing  
signal Hs or Vs produced by the control signal addition  
5   circuit 16 to supply it the first display control  
circuit 19 and supplies the video signals R, G and B to  
the video circuit 20 and the synchronizing signals Hs  
and Vs to the deflection circuit 21, respectively.

          The first display control circuit 19 produces  
10   adjustment signals Sa and Sb for the video circuit 20  
and the deflection circuit 21 on the basis of the  
inputted control signal Sc, respectively, and supplies  
the signals Sa and Sb to the video circuit 20 and the  
deflection circuit 21, respectively, to adjust them.

15           In this way, the display picture is adjusted,  
so that the user's desired picture is displayed in the  
cathode ray tube 22.

          Fig. 2 is a block diagram schematically illus-  
trating an actual example of the control signal addition  
20   circuit 16 of Fig. 1 and Fig. 3 is a waveform diagram  
illustrating waveforms of signals in Fig. 2.

          In Fig. 2, numeral 161 denotes an address  
decoder, 162 a data latch circuit, 163 an edge detection  
circuit for detecting an edge of a pulse, 164 a shift  
25   register circuit, 165 and 170 AND circuits, 166 a level  
conversion circuit for converting a level of a signal,  
167 an analog switch, 168 a counter circuit for counting  
17 clock pulses, and 169 a set and reset type flip-flop

1 circuit (hereinafter, referred to as an RSFF circuit).

Operation of Fig. 2 is now described.

As described above, when the user of the  
computer inputs the control instruction for adjustment  
5 of the display picture of the display unit 1b by means  
of the input unit 10 connected to the computer 1a, the  
input unit interface 12 supplies the control instruction  
to the CPU 11 through a computer bus BUS. Then, the CPU  
11 recognizes the control instruction and supplies a  
10 control data  $C_D$  to the control signal addition circuit  
16 through the computer bus BUS.

The address decoder 161 supplies the control  
data  $C_D$  to the data latch circuit 162 when the control  
data supplied to the decoder is a control data for  
15 adjusting the display picture of the display unit 1b.  
Then, the edge detection circuit 163 detects a leading  
edge of the vertical synchronizing signal  $V_s$  by means of  
the horizontal synchronizing signal  $H_s$  and supplies the  
edge detection pulse  $P_e$  to the shift register circuit  
20 164, the counter circuit 168 and the RSFF circuit 169.

The counter circuit 168 is supplied with the  
edge detection pulse  $P_e$  as a reset signal and with the  
horizontal synchronizing signal  $H_s$  as a clock signal and  
starts its counting operation in response to the rising  
25 edge of the clock signal. When the counter circuit 168  
counts 17 clocks after input of the reset signal, the  
counter circuit produces a carry output signal  $S_{ca}$  which  
is supplied to a reset input terminal of the RSFF

1 circuit 169. Thus, the RSFF circuit 169 produces a V  
gate pulse  $P_v$  as shown in Fig. 3. The control signal  $S_c$   
for the display unit 1b is superposed during a high  
level period  $T_H$  of the V gate pulse  $P_v$ .

5 On the other hand, the shift register circuit  
164 reads the control data  $C_D$  held in the data latch  
circuit 162 in response to the edge detection pulse  $P_e$   
supplied from the edge detection circuit 163. The shift  
register circuit 164 performs the shift operation in  
10 response to the clock signal constituted by the hori-  
zontal synchronizing signal  $H_s$  produced from the AND  
circuit 170 during the high level period  $T_H$  of the V  
gate pulse to produce the control data  $C_D'$  shown in Fig.  
3.

15 Further, the control data  $C_D'$  is supplied to  
the AND circuit 165 which produces a logical product of  
the control data  $C_D'$  and the horizontal synchronizing  
signal  $H_s$ . The output signal of the AND circuit is  
converted into a video signal level by the level  
20 conversion circuit 166 to be supplied to the switch  
circuit 167. Other input of the switch circuit 167 is  
supplied with a B (blue) video signal directly without  
being processed, and the switch circuit 167 selects the  
output of the level conversion circuit 166 during the  
25 high level period  $T_H$  and the B video signal during other  
low level period  $T_L$  by using the V gate pulse  $P_v$  as a  
change-over control signal for the switch to be able to  
obtain a B' video signal on which the control signal is

1 added as shown in Fig. 3. In the embodiment, the  
control signal Sc is added to the B video signal having  
a low visual sensitivity of color, while the control  
signal may be added to other R (red) or G (green) visual  
5 signal or the synchronizing signal Hs or Vs.

Fig. 4 is a block diagram schematically illus-  
trating a first embodiment of the control signal sepa-  
ration circuit 18 and the first display control circuit  
19 of Fig. 1 and Fig. 5 is a waveform diagram showing  
10 waveforms of signals in Fig. 4.

In Fig. 4, numeral 401 denotes a distributor,  
402 a low pass filter (hereinafter referred to as an  
LPF), 403 a level conversion circuit, 404 and 405  
buffers, 406 a divide-by-17 counter or 17-step counter,  
15 407 an RSFF circuit, 408 and 409 AND circuits, 410 an  
inverter, 411 a 16-stage shift register, 412 a decoder  
circuit, 413 a D/A conversion circuit (hereinafter  
referred to as a D/AC), and 414 an edge detection  
circuit.

20 Operation of Fig. 4 is now described with  
reference to Fig. 5.

The B' video signal from the control signal  
addition circuit 16 is supplied to the distributor 401  
which divides the video signal into two signals, one of  
25 which is supplied to the video circuit 20 shown in Fig.  
1 together with other video signals R and G and the  
other of which is supplied to the LPF 402. With the B'  
video signal supplied to the LPF 402, an unnecessary

1 frequency component such as noise contained in the B' video signal is removed in the LPF 402 and the B' video signal is then converted into a digital signal level in the level conversion circuit 403.

5 Further, the vertical synchronizing signal Vs is supplied through the buffer 404 to the edge detection circuit 414, in which the leading edge thereof is detected and is supplied to the 17-step counter 406, the RSFF circuit 407 and the 16-stage shift register 411 as  
10 an edge detection pulse 418 shown in Fig. 5.

When the 17-step counter circuit 406 is reset by the edge detection pulse 418, the 17-step counter circuit 406 starts its counting operation for the horizontal synchronizing signal Hs supplied through the  
15 buffer 405 as a clock signal. Thus, when rising edges of 17 clocks are counted, the counter circuit produces a 17-clock detection pulse. The RSFF circuit 407 is set by the edge detection pulse 418 and reset by the 17-clock detection pulse to produce the V gate pulse 419  
20 shown in Fig. 5.

The AND circuit 408 takes a logical product of an output signal of the level conversion circuit 403 and the V gate pulse of the RSFF circuit 407 to extract the control signal 420 added to the B' video signal.

25 Further, the other AND circuit 409 takes a logical product of the V gate pulse and the horizontal synchronizing signal Hs produced by the buffer 405 and inverted by the inverter 410 to produce a clock signal for the



1 16-stage shift register 411 and the D/AC (D/A Converter)  
413.

5 The 16-stage shift register 411 is reset by  
the edge detection pulse 418 to clear the held contents  
thereof and successively holds the control signal 420 in  
response to the clock signal from the AND circuit 409.  
The decoder circuit 412 decodes four held values at the  
first, second, fifteenth and sixteenth stages of the 16-  
stage shift register 411, and when the decoder circuit  
10 detects the start bit and the stop bit in the control  
signal 420, the decoder circuit produces a load pulse  
422 for the D/AC 413. Further, the output signal from  
the second-stage of the shift register 411 is used as a  
serial data 421 of the D/AC 413 shown in Fig. 5.

15 The D/AC 413, which is a serial input and  
multi-channel D/A converter, selects any of a plurality  
of D/A converters included therein in accordance with  
D/AC control address in the serial data 421 shown in  
Fig. 5 and updates the D/A converted output value in  
20 accordance with a value of the control data portion. At  
this time, the serial data 421 is successively taken in  
the D/AC 413 in synchronism with the clock signal from  
the AND circuit 409 and is settled by the rising edge  
(UP) of the load pulse from the decoder 412.

25 Thus, the video circuit 20 and the deflection  
circuit 21 shown in Fig. 1 can be adjusted by an adjust-  
ment voltage or current produced from the D/AC 413 as an  
adjustment signal.

1            Fig. 6 is a block diagram schematically illus-  
trating a second actual example of the control signal  
separation circuit 18 and the display control circuit 19  
of Fig. 1. In Fig. 6, numeral 601 denotes a selector,  
5    602 a one-chip microcomputer, and 603 a writable read-  
only memory (hereinafter referred to as EEPROM (Electric  
Erasable Programmable Read Only Memory)). Other  
elements having the same number as in Fig. 4 have the  
same function.

10           Operation of Fig. 6 is now described.

          The operation that the control signal  $S_c$  added  
to the B' video signal is separated by the AND circuit  
408 and the clock signal for writing of the shift  
register 411 is prepared by the AND circuit 409 is quite  
15    the same operation as that of Fig. 4. In the second  
example, the microcomputer 602 is used to process the  
control signal to the display unit 1b sent from the  
computer body 1a shown in Fig. 1.

          First of all, usually, the microcomputer 602  
20    controls the selector 601 to select the clock signal for  
writing from the AND circuit 409 and write the control  
signal in the shift register circuit 411. At this time,  
the edge detection pulse from the edge detection circuit  
414 is supplied to the microcomputer 602 as an interrupt  
25    signal 418 and after a predetermined time the microcom-  
puter 602 controls the selector 601 by a selector  
control signal  $S_s$  to select the clock signal  $S_{CL}$  for  
reading from the microcomputer 602.

1           The control signal held in the shift register  
circuit 411 is successively read out in response to the  
clock signal  $S_{CL}$  for reading from the microcomputer 602  
and is supplied to the microcomputer 602. When the  
5   signal supplied to the microcomputer is the correct  
control signal, the microcomputer 602 produces the  
control data to supply it to the D/AC 413 to thereby  
adjust a predetermined circuit in the display unit 1b.  
Further, the control data is also written in the EEPROM  
10 603. Thus, when the display unit 1b is next turned on,  
the control data is read out from the EEPROM 603 to  
perform the predetermined adjustment.

          Further, in the second example, by previously  
storing the control data in the EEPROM 603, a necessary  
15 control data can be read out in accordance with the  
control signal  $S_c$  from the computer body 1a. Accord-  
ingly, the control information for the display unit 1b  
can be previously programmed in the software for  
operating the computer body in addition to the control  
20 information from the input unit 10, so that a predeter-  
mined adjustment can be made for each software.

          As described above, in the first embodiment of  
the present invention, the control signal is added to  
the video signal or the synchronizing signal during the  
25 vertical retrace period, while a DC level itself of the  
video signal can be used as the control signal. In this  
case, the control signal separation circuit 18 may  
reproduce the DC level of the video signal and adjust

1 the predetermined circuit of the display unit 1b in  
accordance with a voltage value of the DC level.  
Further, in the first embodiment, the video circuit 20  
and the deflection circuit 21 of the display unit 1b are  
5 adjusted, while a high-voltage circuit portion can be  
naturally controlled to adjust the focus or the like.

Fig. 7 is a block diagram schematically  
illustrating a second embodiment of the present  
invention. In Fig. 7, numeral 1c denotes a computer  
10 body different from the computer body shown in Fig. 1  
and in the computer body 1c, numeral 70 denotes a  
control signal preparation circuit. Further, numeral 1d  
denotes a display unit different from the display unit  
shown in Fig. 1 and in the display unit 1d, numeral 71  
15 denotes a second display control circuit different from  
the first display control circuit 19 shown in Fig. 1.  
Other elements designated by the same numerals as those  
of Fig. 1 have the same function as that of the elements  
of Fig. 1.

20 Operation of Fig. 7 is now described briefly.

In Fig. 7, the video signal and the synchro-  
nizing signal are produced by the display control  
circuit 15 in the same manner as in a general personal  
computer or work station.

25 When the user of the computer inputs the  
control instruction for adjusting the display picture of  
the display unit 1d by means of the input unit 10 con-  
nected to the computer body 1c, the control instruction

1 is sent to the control signal preparation circuit 70  
through the input unit interface 12, the CPU 11 and the  
computer bus BUS.

The control signal preparation circuit 70  
5 holds the control instruction and prepares the control  
signal corresponding to the control instruction to  
produce it to the display unit 1d at a proper timing.  
An output system of the control signal at this time can  
use an existing interface such as, for example, RS-232C,  
10 GP-IB and SCSI. Accordingly, the control signal pre-  
paration circuit 70 includes the interface circuit.

The second display control circuit 71 of the  
display unit 1d receives the control signal produced by  
the control signal preparation circuit 70 through the  
15 same interface circuit as that included in the control  
signal preparation circuit 70 and produces the adjust-  
ment voltage or current for the video circuit 20 and the  
deflection circuit 21 as the adjustment signal on the  
basis of the received control signal to adjust the video  
20 circuit 20 and the deflection circuit 21.

In the second embodiment of the present  
invention, since the control signal is transmitted and  
received by means of the general-purpose interface, bi-  
directional communication between the display unit 1d  
25 and the computer body 1c can be made. Accordingly, the  
computer body can recognize whether the display unit 1d  
has received the control signal exactly or not, how the  
control state of the display unit 1d at the current time

1 is or whether the display unit 1d is exactly operated or  
not.

Fig. 8 is a block diagram schematically  
illustrating a third embodiment of the present  
5 invention. In Fig. 8, numeral 1e represents a computer  
body different from that of Figs. 1 and 7 and in the  
computer body 1e, numeral 81 represents a display  
processing circuit for preparing an image data for a  
display image, and 82 an interface circuit. Numeral 1f  
10 represents a display unit different from that of Figs. 1  
and 7, 83 an interface circuit, and 84 a display con-  
troller for preparing various signals for driving the  
display unit 1f. The interface circuits (hereinafter  
referred to as an I/F circuit) 82 and 83 serve to  
15 transmit and receive signals between the display  
processing circuit 81 in the computer body 1e and the  
display controller 84 in the display unit 1f. Other  
elements having the same numerals as those of Figs. 1  
and 7 have the same function.

20 Operation of Fig. 8 is now described.

An image processing instruction issued by the  
CPU 11 is supplied to the display processing circuit 81  
through the computer bus BUS. The display processing  
circuit 81 receives the image processing instruction and  
25 prepares the image data for the display image.

At this time, when the user of the computer  
inputs the control instruction for adjusting the display  
picture of the display unit 1f by means of the input

1 unit 10 connected to the computer body 1e, the control  
instruction is sent to the display processing circuit 81  
through the input unit interface 12, the CPU 11 and the  
computer bus. When the display processing circuit 81  
5 receives the control instruction, the display processing  
circuit 81 prepares the control signal in a predeter-  
mined location other than the image data area.

The image data and the control signal thus  
prepared are sent to the display unit 1f through the I/F  
10 circuit 82 as the image information in accordance with a  
predetermined interface specification, for example, the  
SCSI standards having a large transfer rate.

In the display unit 1f, the I/F circuit 83  
receives the image information from the I/F circuit 82  
15 and supplies the image information to the display  
controller 84 successively. The display controller 84  
writes the received image information into an internal  
memory successively and prepares the video signals for  
R, G and B and the synchronizing signal from the image  
20 data portion of the written image information. Further,  
when the control signal is present in the image infor-  
mation, the adjustment voltage or current as the  
adjustment signals Sa' and Sb' for the video circuit 20  
and the deflection circuit 21 is produced to adjust the  
25 video circuit 20 and the deflection circuit 21.

In addition, when the image information  
written in the internal memory of the display controller  
84 is not updated within a predetermined time, the

1 display controller 84 controls the video circuit 20 to  
minimize an amplitude level of the video signal, so that  
the brightness of the cathode ray tube 22 is reduced to  
prevent burning of the cathode ray tube 22.

5 Even in the third embodiment of the present  
invention, since the interfaces between the computer  
body 1e and the display unit 1f have the capability for  
bidirectional communication, not only the image data and  
the control signal can be transmitted from the computer  
10 body 1e but also a signal for reception confirmation and  
a report signal for operation situation can be trans-  
mitted from the display unit 1f. Further, since the  
computer body 1e is connected to the display unit 1f  
through a single interface cable, the complexity of the  
15 connection can be solved.

Fig. 9 is a block diagram schematically  
illustrating a fourth embodiment of the present  
invention. In Fig. 9, numeral 1g represents a computer  
body different from that of Figs. 1, 7 and 8, and in the  
20 computer body 1g, numeral 91 represents a modulation  
circuit. Numeral 1h represents a display unit different  
from that of Figs. 1, 7 and 8, and in the display unit  
1h, numeral 92 represents a display control circuit, 93  
a demodulation circuit, and 94 and 95 power plugs.  
25 Other elements having the same numerals as those of Fig.  
1 have the same function.

Operation of Fig. 9 is now described.

When the user of the computer inputs the



1 control instruction for adjusting the display picture of  
the display unit 1h by means of the input unit 10 con-  
nected to the computer body 1g, the control instruction  
is supplied to the CPU 11 through the input unit inter-  
5 face 12. The CPU 11 processes the control instruction  
and supplies the control signal corresponding to the  
control instruction to the modulation circuit 91 through  
the computer bus BUS. The modulation circuit 91 modu-  
lates the received control signal and superposes it to  
10 the AC power to transmit the signal from the power plug  
94 through a power line PL to the display unit 1h.

In the display unit 1h, when the AC power is  
supplied from the power plug 95 through the power line  
PL, the demodulation circuit 93 demodulates the modu-  
15 lated control signal superposed on the AC power to  
reproduce the original control signal. The reproduced  
control signal is supplied to the display control  
circuit 92. The display control circuit 92 produces the  
adjustment voltage or current as the adjustment signals  
20 Sa and Sb for the video circuit 20 and the deflection  
circuit 21 in accordance with the contents of the  
control signal to adjust the video circuit 20 and the  
deflection circuit 21.

In this manner, in the embodiment, since the  
25 control signal is transmitted to the display unit 1h  
through the power line PL, the display unit 1h can be  
controlled without increased signal line for the control  
signal.

1            Fig. 10 schematically illustrates a fifth  
embodiment of the present invention. The fifth embodi-  
ment is now described briefly. In Fig. 10, numeral 1  
represents a computer body constituted by a general  
5    personal computer or work station, 1j a display unit  
different from that of the preceding embodiments, 101 a  
second input unit such as a keyboard, a mouse, or a pen  
for unit connected to the computer body 1 and the  
display unit 1j, 102 a command identification circuit in  
10    the display unit, and 103 a third display control  
circuit. Other elements having the same numerals as  
those of Fig. 1 have the same function.

          In Fig. 10, when the user of the computer  
operates the second input unit 101, an input signal such  
15    as the control instruction is inputted to the computer  
body 1 and the display unit 1j. The input signal input-  
ted to the display unit 1j is processed by the command  
identification circuit 102 and is taken out as the  
display control signal when the input signal is an  
20    instruction relative to the display control. The third  
display control circuit 103 makes control relative to  
the display operation by the control voltage or current  
with respect to the associated portion of the video  
circuit 20 and the deflection circuit 21 on the basis of  
25    the display control signal. In the embodiment of Fig.  
10, since the computer body does not prepare the control  
signal for the display, there is no burden bearing upon  
the CPU of the computer. In this manner, the user of

1 the computer can control the display unit by means of  
the second input unit without direct contact to the  
display unit. The signal line connected from the second  
input unit 101 to the display unit 1j may use the signal  
5 lines connected to the computer body 1 as they are or  
may be an exclusive signal line for transmitting only  
the display control signal. For the former case, the  
input unit such as the general keyboard can be utilized  
as it is. For the latter case, it is necessary to add a  
10 special input unit for display control to the second  
input unit. Further, a remote control circuit employing  
the infrared rays or the like is used to reduce the  
number of connection lines between the second input unit  
101 and the display unit 1j, so that the complexity due  
15 to wiring can be reduced. In the fifth embodiment, an  
input unit such as a mouse, a touch panel, a pen for  
input or the like can be naturally used as the input  
means for the control instruction in addition to the  
keyboard.

20 According to the present invention, the  
following effects are attained:

- (1) The user of the computer can adjust the  
display picture by the input unit such as the keyboard  
near at hand through the computer body without extending  
25 the hands to adjustment switches of the display unit.
- (2) The user can obtain the necessary display  
state exactly.
- (3) The operability in the computer system and the

- 1 handling capability of the display unit are improved.
- (4) The individual user can adjust the display state of the image display apparatus in accordance with circumstances.
- 5 (5) The adjustment of the display picture can be attained with the minimum control hardware.
- (6) Standard lines can be used without the provision of new lines.
- (7) The complexity due to wiring can be avoided by  
10 using the remote control circuit.
- (8) It is possible to automatically adjust the optimum picture to be displayed on the display unit by adjusting the operation of software by means of the control program of a display integrated into the  
15 application program at the computer side, and accordingly it is unnecessary for the user to take care the adjustment of the display.